DOCUMENT RESUME

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IDENTIFIERS	Customer Relations

ABSTRACT

This combination progress record and course outline is designed for use by individuals teaching a course in precision sheet metal. Included among the topics addressed in the course are the following: employment opportunities in metalworking, measurement and layout, orthographic projection, precision sheet metal drafting, simple layout, hand tools, bench tools, power machines and equipment, materials, procedures for reading blueprints, layout and development, radial line development, triangulation, fabrication, welding, metal finishing, plastics, safety, customer relations, and business practices. In addition to the theory outline, which includes space for recording information concerning the scheduling and presentation of the lesson material, this record book also contains a list of course objectives for grades 10, 11, and 12 and a grid for use in recording the individual student's mastery of each specific skill taught in the course. (MN)

PROGRESS RECORD

AND

THEORY OUTLINE

PRECISION SHEET METAL

DIVISION OF VOCATIONAL-TECHNICAL SCHOOLS

CONNECTICUT DEPARTMENT OF EDUCATION

1983-1984

GENERAL OBJECTIVE

Student will be able to:

Use their knowledge and skills to satisfactorily perform in the Precision Sheet Metal Trade, as advanced apprentices.

COURSE OBJECTIVES

Grade 10

1. Learn how to read and interpret simple precision sheet metal blueprints.
2. Become proficient in the use and care of measuring tools, hand tools, bench tools.
3. Fabricate projects using standard shop tools and equipment.
4. Determine the gauge, blank size and equality of metals used in precision sheet metal.
5. Do basic Oxy-Acetylene brazing. Know operational features of equipment, procedures and safety practices. Do brazing with gas eqipment.
6. Recognize safety hazards and practice all safety precautions.

Grade 11

1. Work with cold rolled steel, stainless steel, aluminum and other metals used in precision sheet metal work.
2. Read blueprints and know symbols and abbreviations.
3. Understand development by using radial line development for tapered parts.
4. Use power equipment, know the parts, proper maintenance and safety features.
5. Practice Electric Arc Welding. Understand the use of various types of arc welding equipment and supplies.
6. Use plane figures for development and geometric construction.
7. Recognize safety hazards and practice all safety precautions.

Grade 12

1. Practice Mig Welding. Know how to use and set up mig welding equipment and supplies.

2. Practice Tig Welding. Set up and operate heli-arc equipment.

3. Interpret advanced blueprints for precision sheet met. parts.

4. Become proficient in the use of all precision sheet metal equipment available.

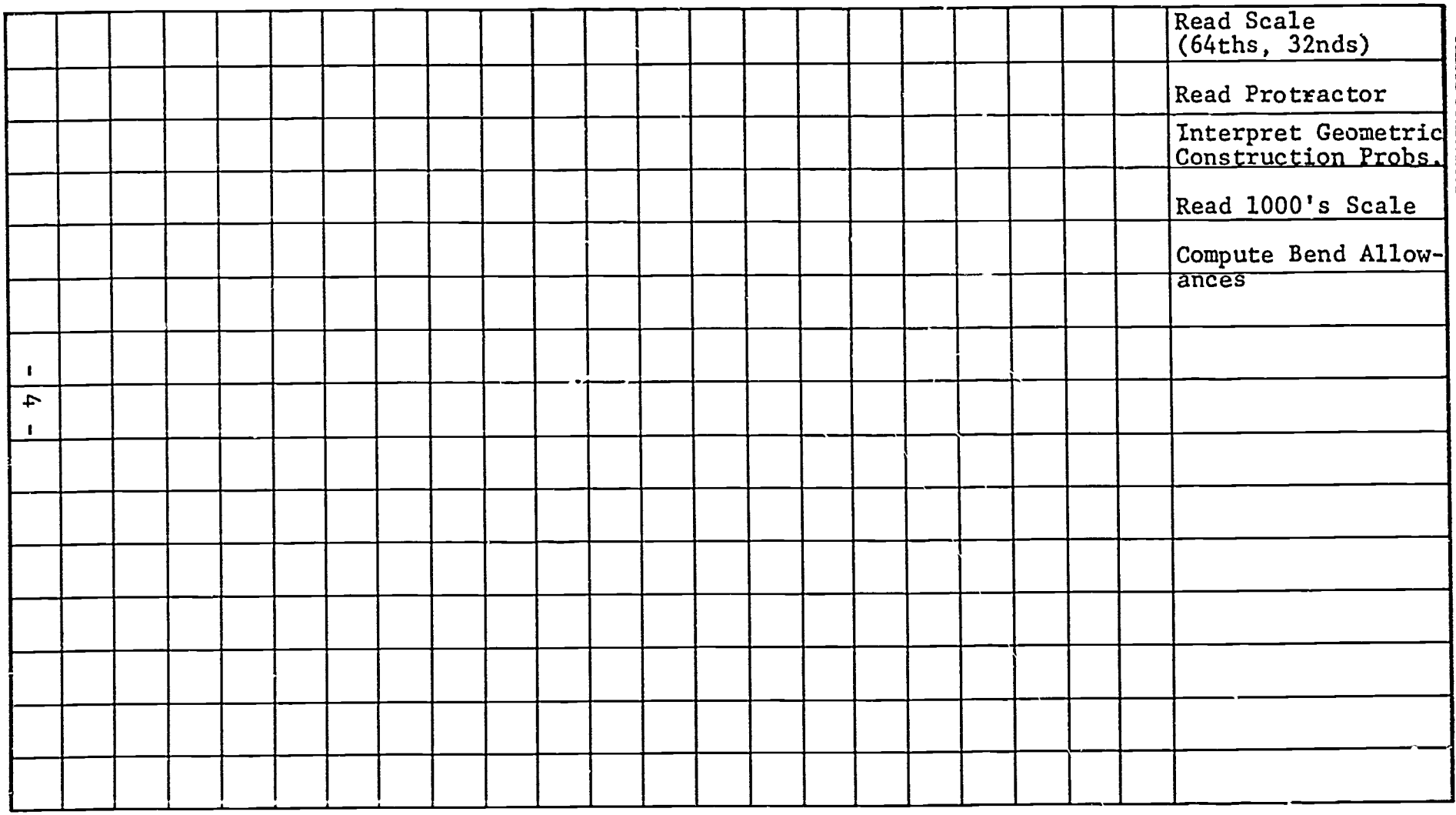
5. Know the application and use of plastics in precision sheet metal.

6. Draw and develop patterns using Triangulation.

7. Use precision power equipment, know parts, proper maintenance, safety features, and set up same.

8. Know degreasing and painting procedures.

9. Recognize safety hazards and practice all safety precautions.


Read Scale (64ths, 32nds)
Read Protractor
Interpret Geometric Construction Probs.
Read 1000's Scale
Compute Bend Allowances
MEASUREMENT

ORTHOGRAPHIC PROJECTION

																					Read Three-View Drawings
																					Read Sectional Views
																					Read Auxiliary View
																					Identify Line, Dimensions
																					Draw Three View Drawings
																					Draw Sectional Views
																					Draw Auxiliary Views
- 5 -																					Draw Cone and Pyramid
																					Identify Relation-ship of positions
																					Layout Geometric Construction

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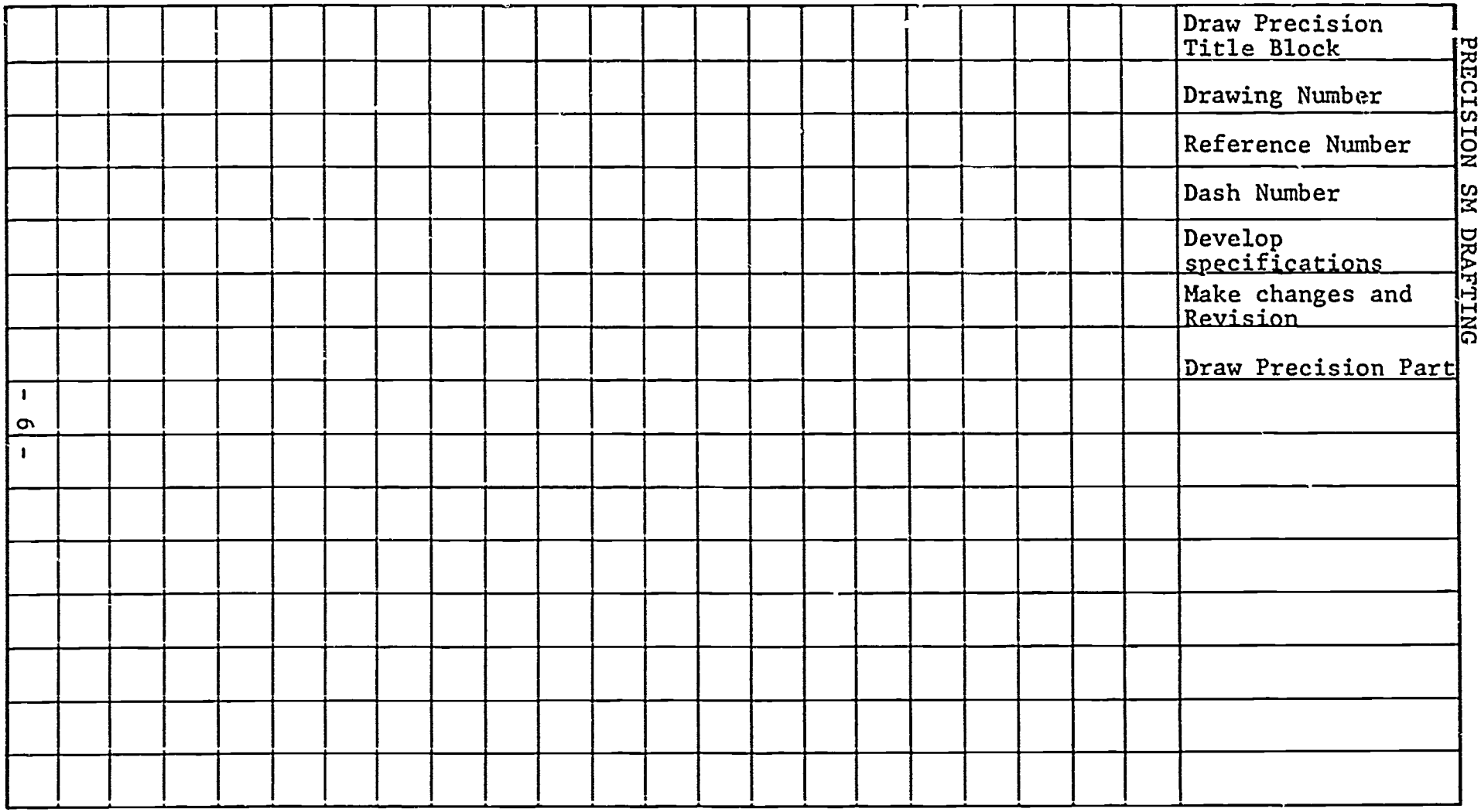

PRECISION SM DRAFTING

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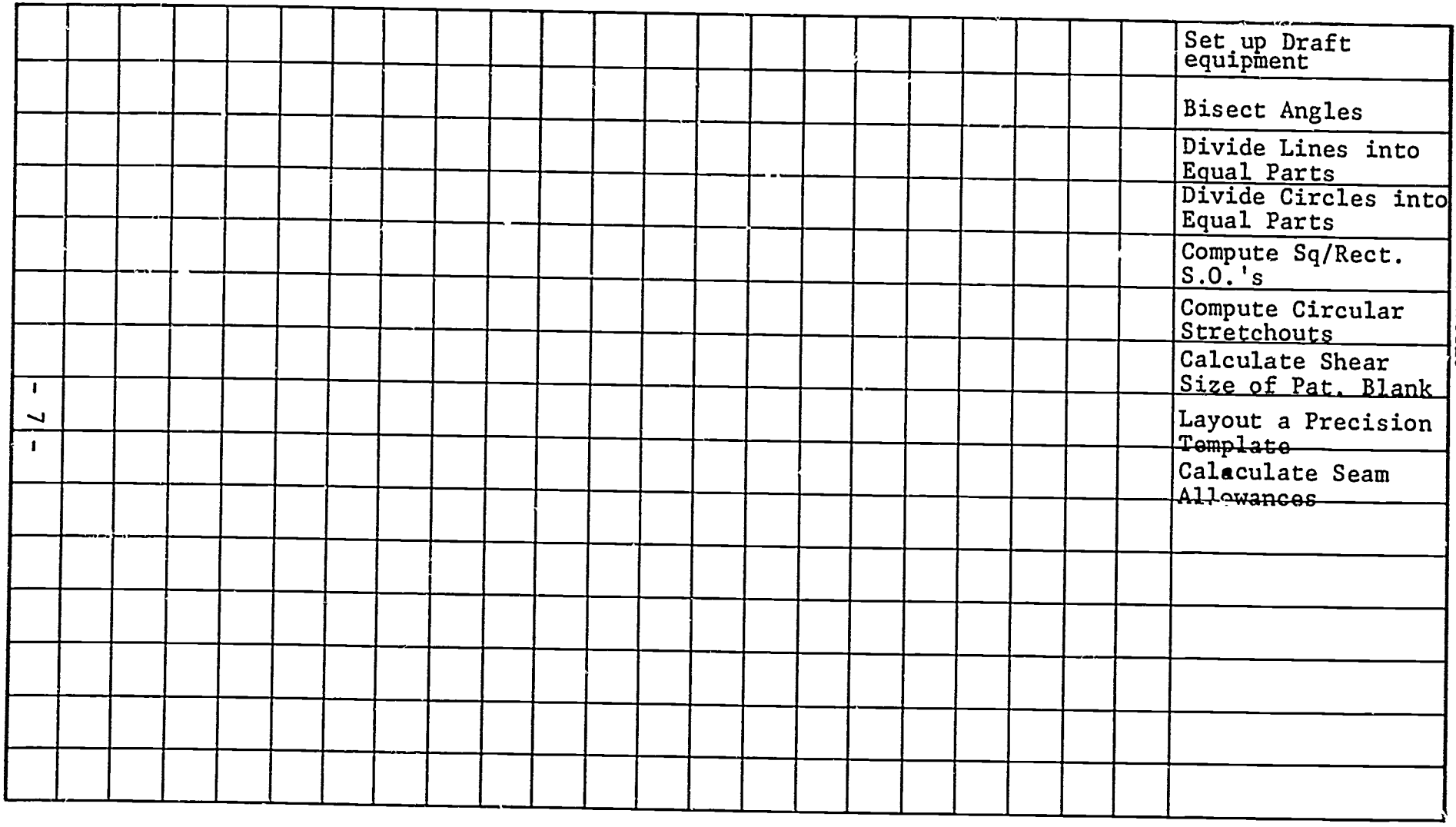
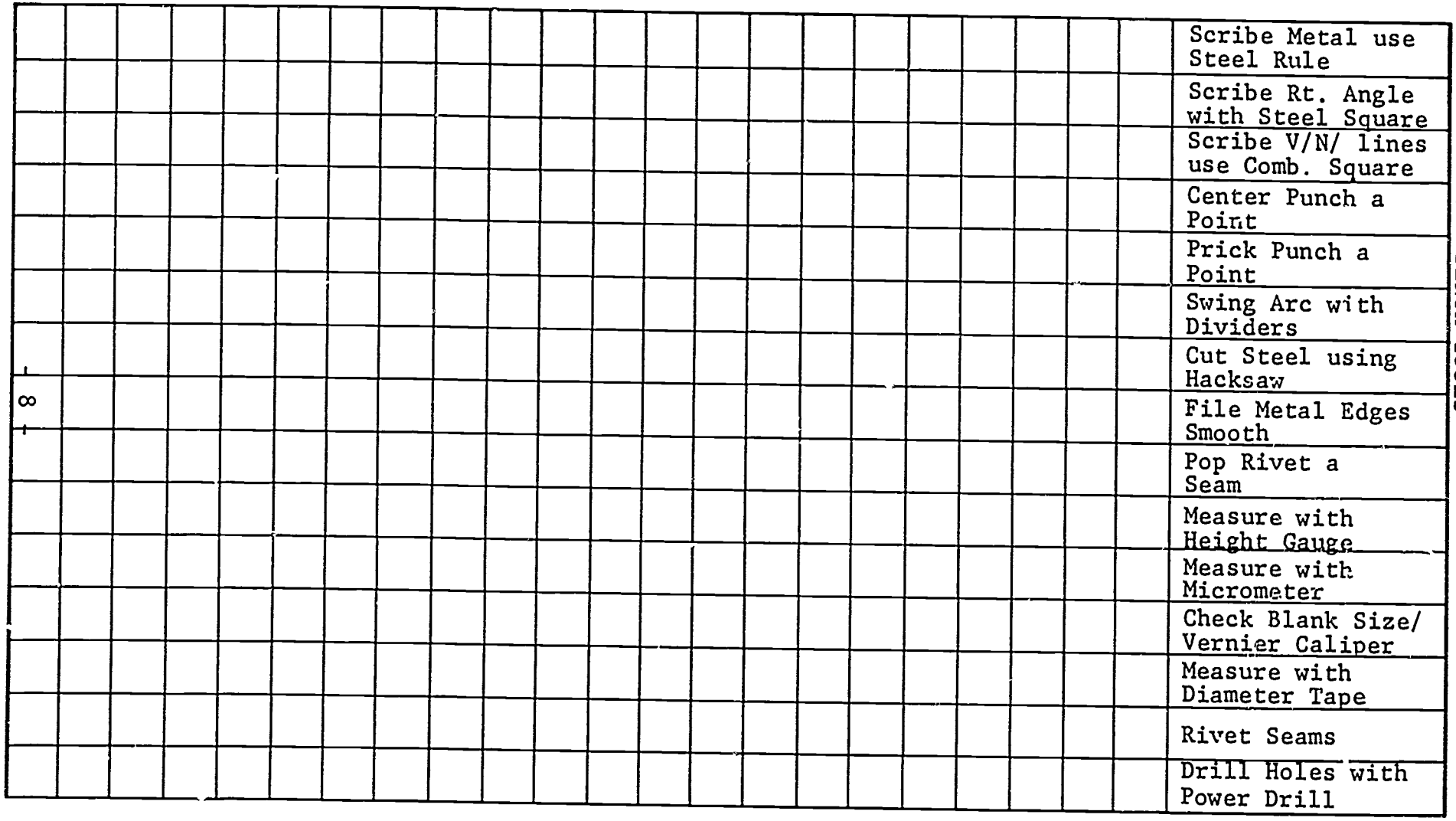

Set up Draft equipment
Bisect Angles
Divide Lines into Equal Parts
Divide Circles into Equal Parts
Compute Sq/Rect. S.O.'s
Compute Circular Stretchouts
Calculate Shear Size of Pat. Blank
Layout a Precision Template
Calaculate Seam Allowances
SIMPLE LAYOUT WORK


HAND TOOLS - BENCH TOOLS
Scribe Metal use Steel Rule
Scribe Rt. Angle with Steel Square
Scribe V/N/ lines use Comb. Square
Center Punch a Point
Prick Punch a Point
Swing Arc with Dividers
Cut Steel using Hacksaw
File Metal Edges Smooth
Pop Rivet a Seam
Measure with Height Gauge
Measure with Micrometer
Check Blank Size/ Vernier Caliper
Measure with Diameter Tape
Rivet Seams
Drill Holes with Power Drill
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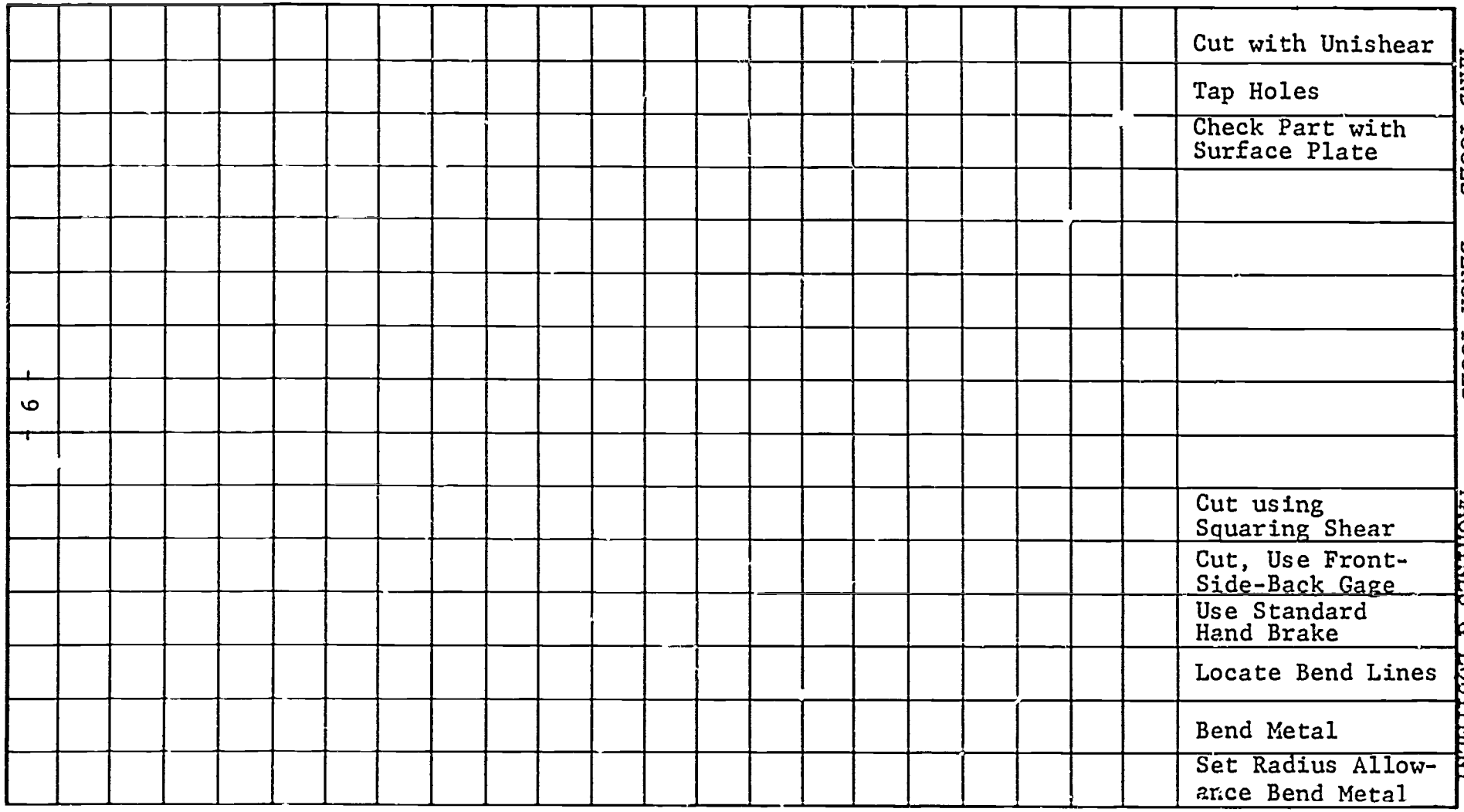
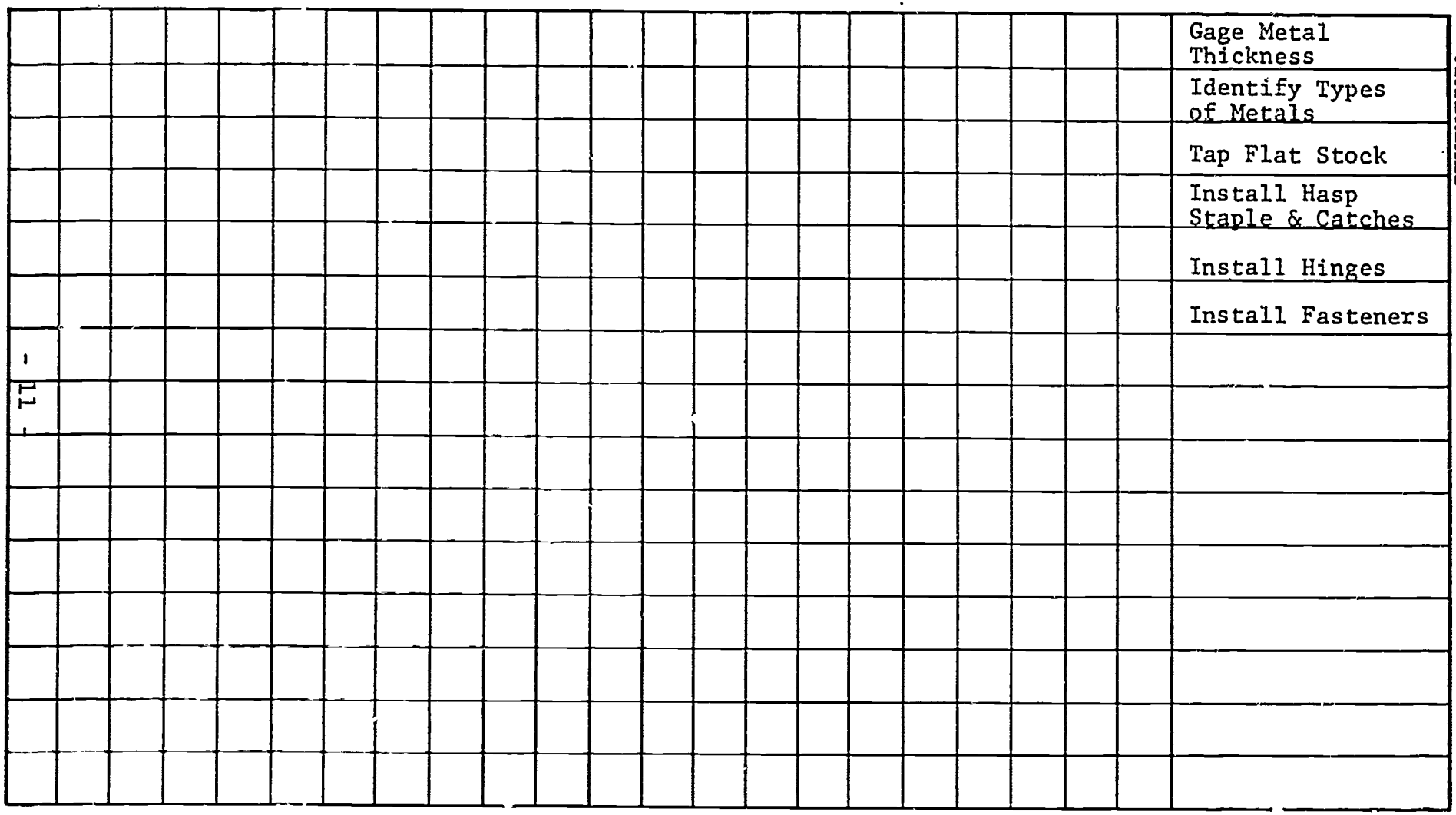

HAND TOOLS - BENCH TOOLS
MACHINES & EQUIPMENT
Cut with Unishear
Tap Holes
Check Part with Surface Plate
Cut using Squaring Shear
Cut, Use Front-Side-Back Gage
Use Standard Hand Brake
Locate Bend Lines
Bend Metal
Set Radius Allowance Bend Metal

Tighten Bend & Clamp Tension
Change Bending Dies
Adjust/Set Finger/ Pan Brake
Bend Sides of a Box
Set Stops on Notcher
Install Punch & Di with Foot Press
Install Punch & Die with Metal Press
Align Punches, use Nibbling Machine
Shear, Slit, Notch with Comb. Noter.
Coper Shear

- 10 --


MATERIALS
Gage Metal Thickness
Identify Types of Metals
Tap Flat Stock
Install Hasp Staple & Catches
Install Hinges
Install Fasteners

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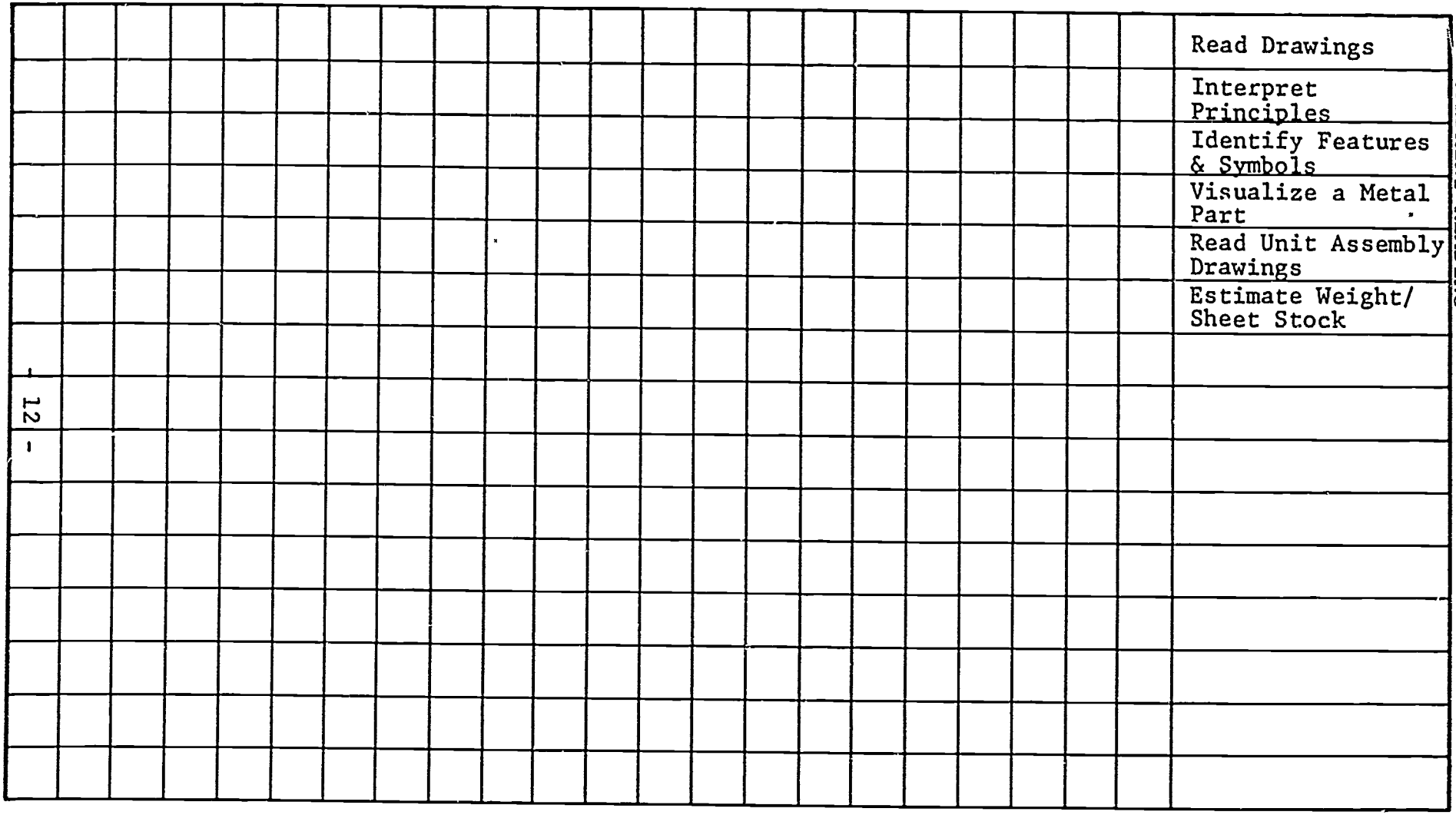

BLUEPRINT READING

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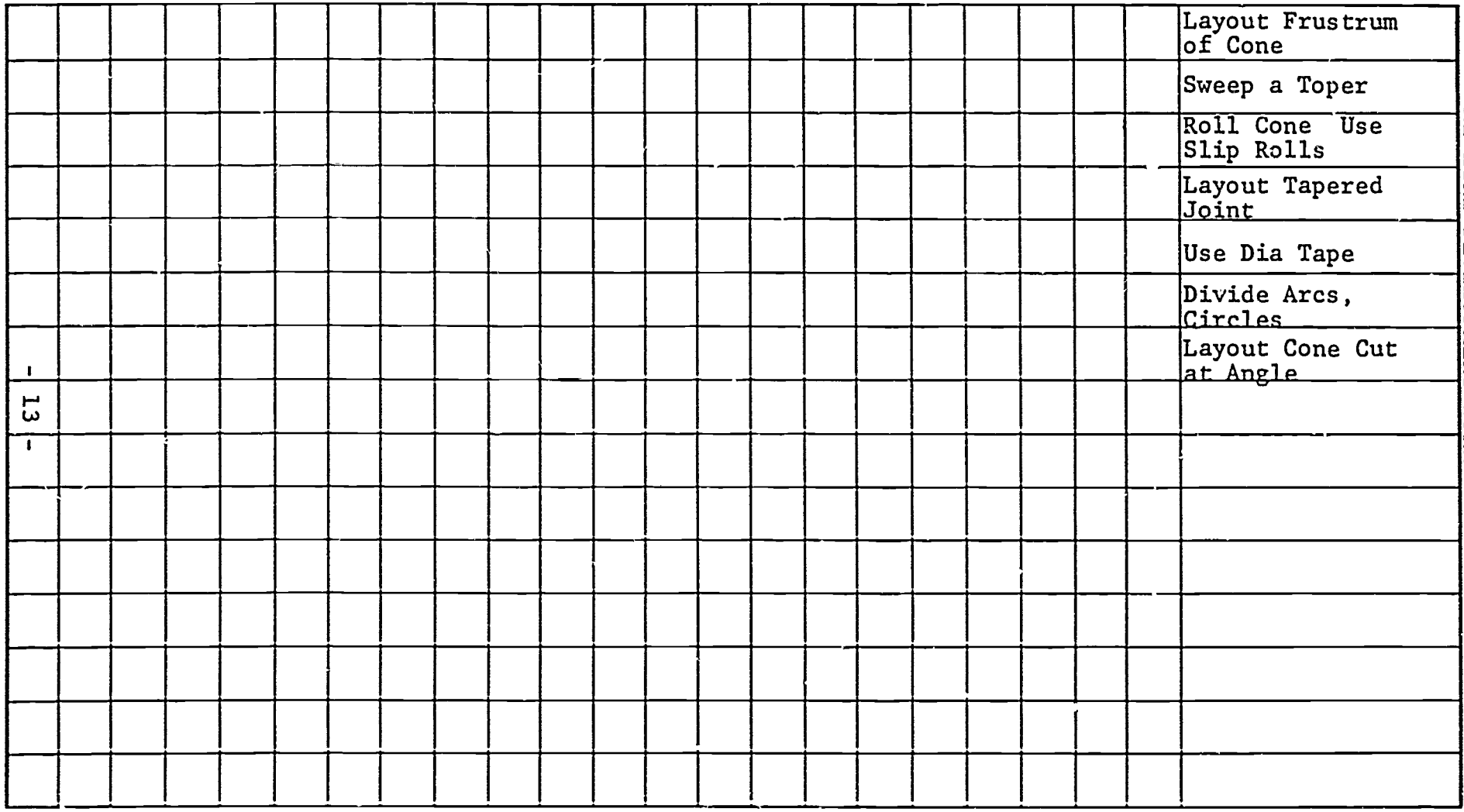

Layout Frustrum of Cone
Sweep a Toper
Roll Cone Use Slip Rolls
Layout Tapered Joint
Use Dia Tape
Divide Arcs, Circles
Layout Cone Cut at Angle

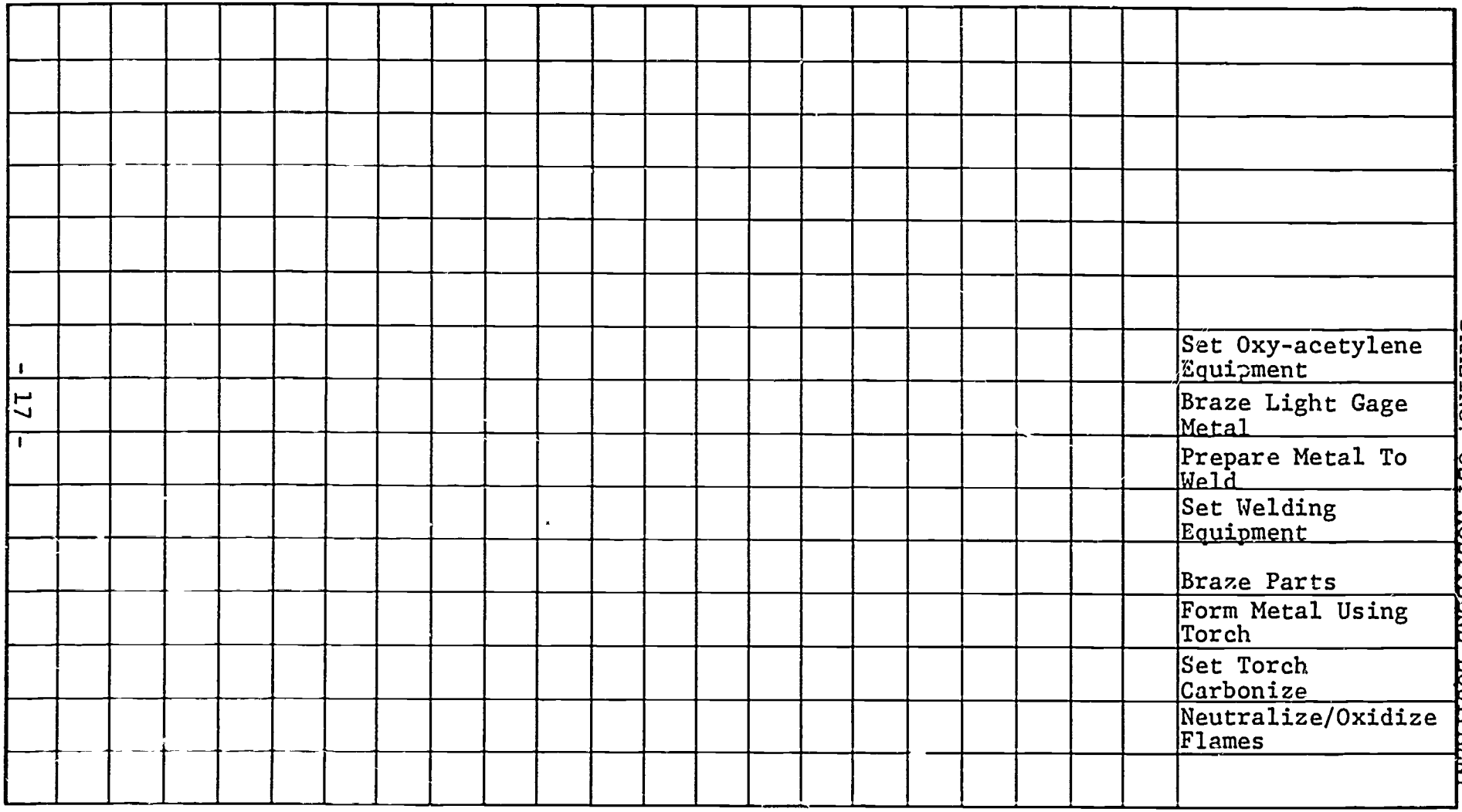
Construct, identify parts of triangle
Layout trz sides Taperin
Layout with carpenter square
Roll use brake
Dev. vert. tapered square to round
Layout square to round
Triangulate a cone

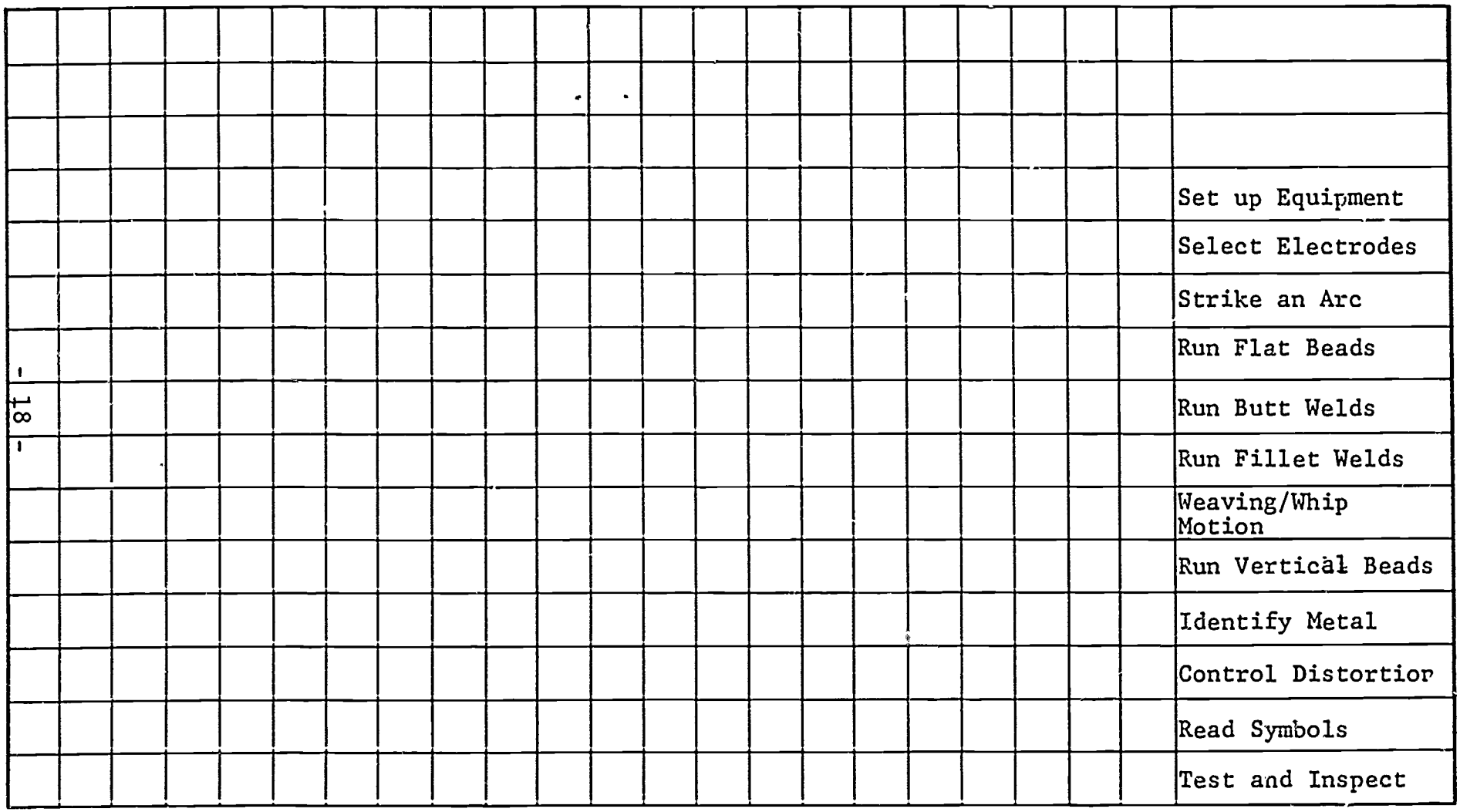
POWER EQUIPMENT

	Use Power Shear
	Use Power Brake
	Clean/Change Electrodes
	Set Machine for var. Gage Material
	Spot Weld Several Gages Together
	Test Weld Strength by Bending
	Check Weld Penetration
	Prepare Metal for Spot Welder
	Repair Bad Spots Welds
	Set Drill Speeds
	Burr Holes
	Counter Drill
	Grind Punches
	Sharpen Drills
	Dress Wheels

POWER EQUIPMENT

	Install Blades
	Saw Flat Stock
	Set Upper and Lower Die
	Bend Metal 30°-90°
	Flatten Stamp & Crossbend
	Punch Louvers
	Make Radius Bends
	Install Punch & Die
	Make and Mount Strippers
	Punch Holes, All Sizes
	Sear Metal Using Gauges
	Setup/Use Power Roll
	Punch Round Square Holes
	Use Portable Grinder


BRAZING: OZY-ACETYLENE EQUIPMENT
Set Oxy-acetylene Equipment
Braze Light Gage Metal
Prepare Metal To Weld
Set Welding Equipment
Braze Parts
Form Metal Using Torch
Set Torch Carbonize
Neutralize/Oxidize Flames
- 17 -
10 / 83


ARC WELDING
Set up Equipment
Select Electrodes
Strike an Arc
Run Flat Beads
Run Butt Welds
Run Fillet Welds
Weaving/Whip Motion
Run Vertical Beads
Identify Metal
Control Distortion
Read Symbols
Test and Inspect
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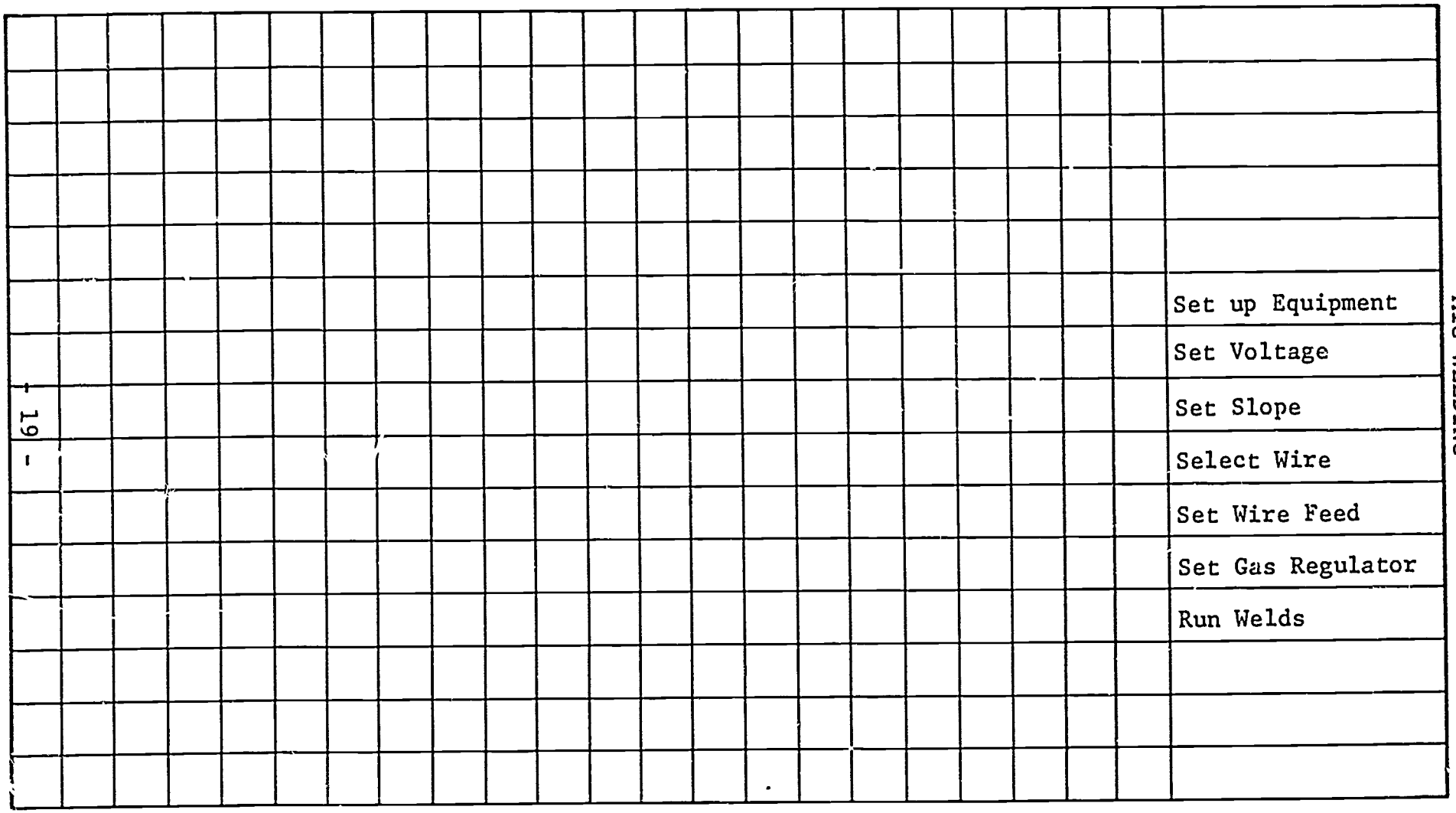
MIG WELDING
Set up Equipment
Set Voltage
Set Slope
Select Wire
Set Wire Feed
Set Gas Regulator
Run Welds
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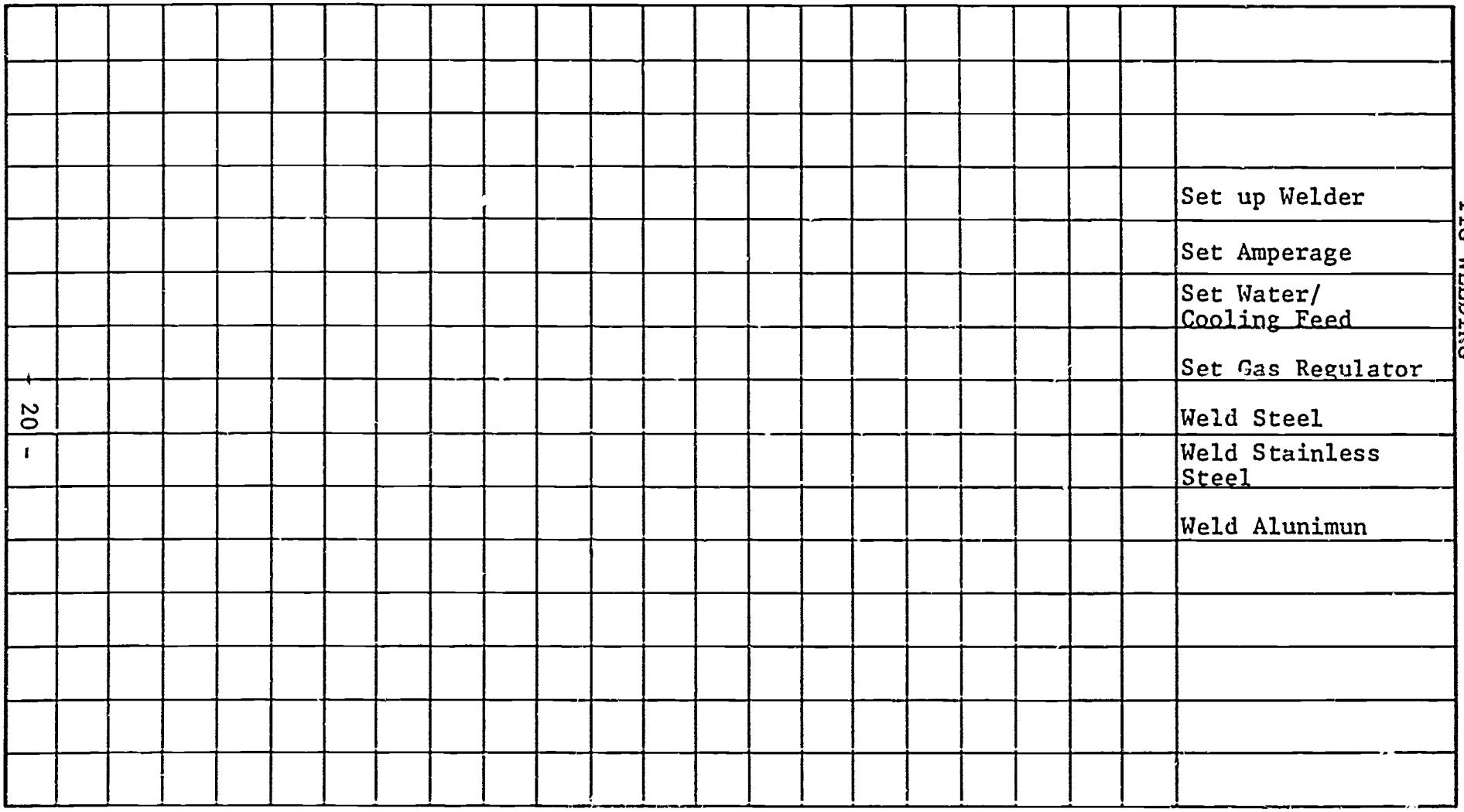
10 / 83


TIG WELDING
Set up Welder
Set Amperage
Set Water/ Cooling Feed
Set Gas Regulator
Weld Steel
Weld Stainless Steel
Weld Alunimun
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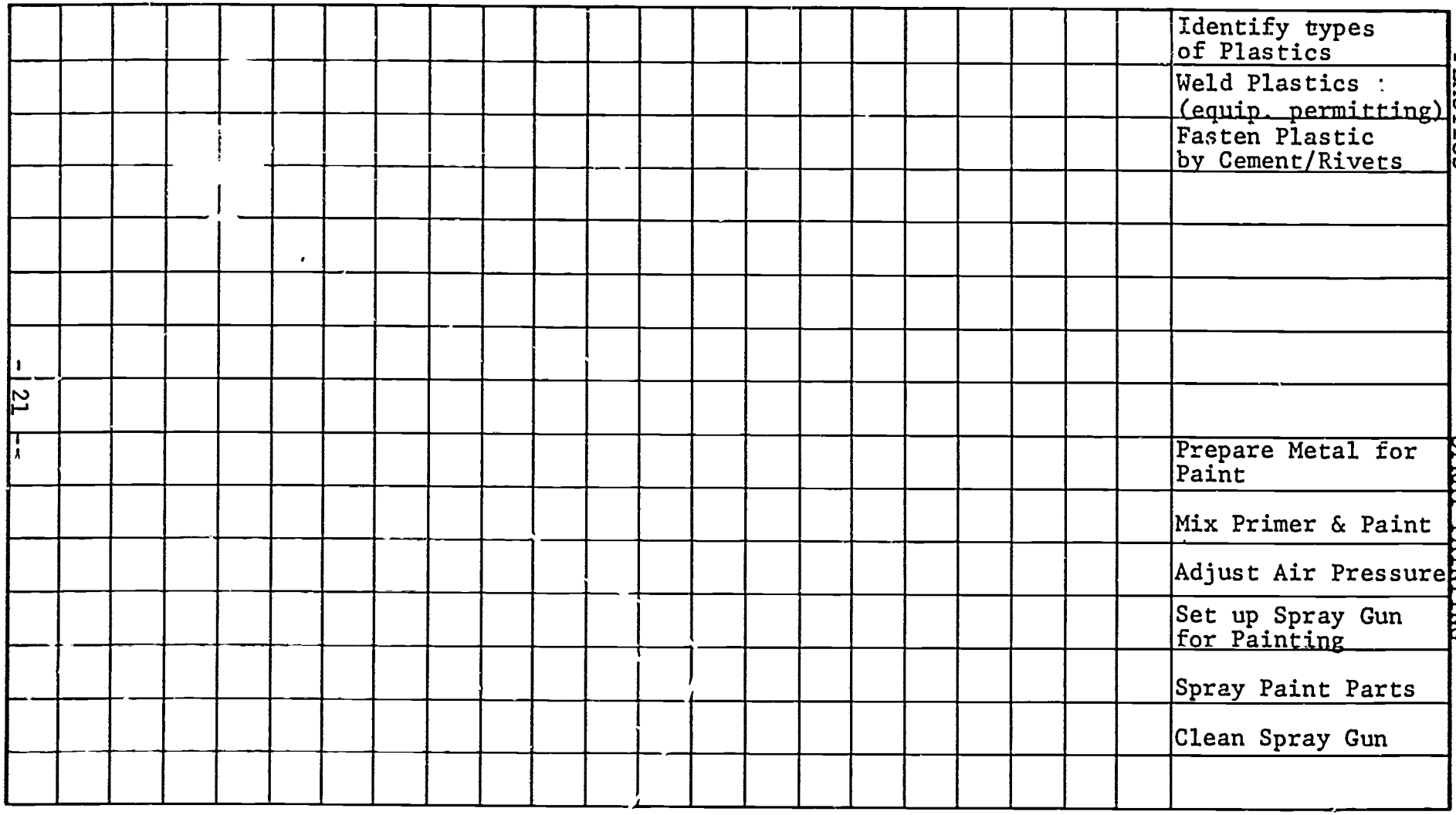
PLASTICS
Identify types of Plastics
Weld Plastics : (equip. permitting)
Fasten Plastic by Cement/Rivets
SPRAY PAINTING
Prepare Metal for Paint
Mix Primer & Paint
Adjust Air Pressure
Set up Spray Gun for Painting
Spray Paint Parts
Clean Spray Gun

TRADE THEORY OUTLINE

I. TRADE INTRODUCTION AND OPPORTUNITIES

II. MEASUREMENT AND LAYOUT

III. ORTHOGRAPHIC PROJECTION

IV. PRECISION SHEET METAL DRAFTING

V. SIMPLE LAYOUT

VI. HAND TOOLS - LAYOUT TOOLS

VII. BENCH TOOLS

VIII. MACHINES AND EQUIPMENT: BENCH AND FLOOR PRECISION EQUIPMENT

IX. MATERIALS: STEEL AND STEEL STOCK, ALLOYS

X. MATERIALS: FASTENERS, ALUMINUM, STAINLESS STEEL

XI. BLUEPRINT READING SYMBOLS

XII. LAYOUT AND DEVELOPMENT

XIII. RADIAL LINE DEVELOPMENT

XIV. TRIANGULATION

XV. MACHINES AND EQUIPMENT: POWER DQUIPMENT

XVI. FABRICATION: CONE, SQUARE TO ROUNDS, ROUND TO ROUND

XVII. WELDING: OXYACETYLENE

XVIII. WELDING; ELECTRIC ARC

XIX. WELDING; MIG

XX. WELDING: TIG

XXI. METAL FINISHING

XXII. MATERIALS: PLASTICS

XXIII. SAFETY

XXIV. CUSTOMER RELATION AND BUSINESS PRACTICES

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

I. TRADE INTRODUCTION AND OPPORTUNITIES

A. History of the Trade

1. Guilds
2. Apprenticeship
3. Management

B. Scope of Trade

1. Job shops
2. Manufacturing companies
3. Shipbuilding
4. Aircraft
5. Defense
6. Communications
7. Welding
8. Others

C. Trade Opportunities

1. Machine operators
2. Metal finishers
3. Fabricators
4. Assembly
5. Set up
6. Inspectors
7. Model makers

D. Qualifications

1. High level of mechanical ability, dexterity
2. Resourcefulness in solving problems
3. Blueprint reading ability
4. Pride in workmanship

II. MEASUREMENT AND LAYOUT

A. Linear Measurement

1. Units; foot, inch
2. Fraction and decimal divisions
3. Rules, steel scale
4. Dia tape

B. Scale Measurement

1. Graduations of scales
2. Measure lines
3. 1000's scale, decimals

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

C. Angular Measurement

1. Terminology
2. Units: degrees, minutes, seconds
3. Symbols
4. Protractor
5. Measuring angles

D. Geometric Constructions

1. Terminology
2. Bisecting lines, angles
3. Polygons within a circle
4. Triangles
5. Tangents

E. Precision Sheet Metal Math

III. ORTHOGRAPHIC PROJECTION

A. Terms, Definitions

B. Views

1. Plan, front, end
2. Glass cage relationships
3. Three view drawing
4. Orthographic vs pictorial
5. Sectional views, auxiliary views

C. Lines, Identifications

1. Solid, heavy outlines (primary lines)
2. Light lines, projection lines (secondary lines)
3. Dashes, center lines, break lines
4. ASA line conventions

D. Planes, Theory of Projection

1. Viewing positions (eye level)
2. Imaginary, horizontal lines
3. Cutting planes

E. True Lengths of Lines

1. Foreshortened views

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

IV. PRECISION SHEET METAL DRAFTING

A. Title Block and Title Strip

1. Name and address of company
2. Name of part
3. Serial prefix
4. Scale

B. Drawing a Metal Part

1. Three views

C. Develop Specifications

D. Make Changes and Revisions

V. SIMPLE LAYOUT WORK, INCLUDING PRECISION TEMPLATES

A. Introduction

1. Layout work

B. Types of Layout and Development

1. Simple layout
2. Radial line development
3. Triangulation

C. Mechanical Drawing Equipment

1. Drawing board, T-square, angles
2. Scale rule (1000's)
3. Pencils (H) compass
4. Protractor
5. Etc.

D. Using Drawing Equipment

1. Position drawing board
2. Tape corners
3. Pull tight, straighten
4. Placement and movement of T-square
5. Types, use of triangles
6. Tilt pencil in, sharpening pencils
7. Use of bow compass
8. Scale rule
9. Protractor

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

E. Development of Patterns

1. Computation of stretchout
   a. Views required for square, rectangular jobs
   b. Rules for development
   c. Formulas
   d. Stretchouts
   e. Seams
   f. Bend radius allowance
2. Stretchout of a box
   a. Views
   b. Formula
   c. Rule
   d. Stretchout
   e. Bend allowance
   f. Notches
3. Stretchout of circular jobs
   a. Views
   b. Rule
   c. Formula
   d. Pi
   e. Stretchout

F. Fabrication of Patterns

1. Layout tools
2. Bend and assemble

G. Computing Sizes of Materials

1. Find size of materials needed for precision parts

H. Precision Template Work

1. Proper lengths
2. Blank sizes
3. Define parts
4. Series of bends

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

VI. HAND TOOLS - LAYOUT TOOLS

A. Description and Use of Layout Tools

1. Scratch awl
2. Prick punch
3. Straight edge
4. Flat steel square
5. Combination square
6. Center punch
7. Dividers
8. Trammel points
9. Height gage
10. Micrometer
11. Vernier caliper
12. Diameter tape
13. Dial indicators
14. Others

B. Using Layout Tools

1. Scribing a line on metal
2. Laying out right angles with a steel square
3. Scribing vertical line with combination square
4. Scribing horizontal edgelines with combintaion square
5. Marking with prick punch and center punch
6. Setting and using dividers, trammel points
7. Measure blank size with vernier calipers
8. Check dia with dia tape

VII. BENCH TOOLS

A. Hammers

1. Safety
2. Uses
3. Ball peen, mallets

B. Vises, Clamps

1. Safety
2. Removable jaws, use of vises
3. C-clamps, parallel clamps

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

C. Hand Hacksaw

1. Safety
2. Use, blades, teeth
3. Angle of cut

D. Small Tools

1. Safety
2. All small hand tools such as screwdrivers, wrenches, files, pliers, vice grips, pop-rivet gun, tapping sets, etc.

E. Surface Plate

1. Use to check flat
2. Use with dial indicator
3. Use with height gage

F. Power Tools

1. Safety
2. Drills; uses, parts, drill bits, sizes
3. Unishears: uses, parts, adjust blades, maintenance
4. Portable grinder

VIII. MACHINES AND EQUIPMENT - BENCH, FLOOR, PRECISION

A. Standard Hand Brake

1. Safety
2. Use, types, gauge, capacity, adjustments, parts
3. Set for radius bends
4. Change blades

B. Pan and Box Brake

1. Safety
2. Advantages

C. Squaring Shear

1. Safety
2. Types, gauges, use, parts
3. Blades adjustment, maintenance
4. Correct user stance, operation
5. Front, back, side gauges

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

D. Slip Roll Former

1. Safety
2. Use, parts
3. Adjustment of rolls
4. Rolling tapered fittings

E. Notcher

1. Safety: watch hands while operating machine
2. Set stops
3. Size of notch

F. Foot Press

1. Safety: coordinate foot and hand movements
2. Check stripper plates
3. Tighten die shoe bolts
4. Check alignments
5. Check ram adjustment

G. Hand Metal Punch and Cam Press

1. Safety: keep hands away from punch
2. Match punch and die sizes
3. Change stripper plate with dies
4. Center punch in die carefully
5. Depth adjustments
6. Compensate for wear by removing gib shims

H. Nibbling Machine

1. Safety: protect eyes
2. Hand cutting an edge
3. 1/32 - 1/16 at bottom of stroke
4. Avoid vibration, secure stock
5. Starting hole for inside circles
6. Outside edge cuts
7. Square inside slots

I. Comb. Notcher, Coper, Shear

1. Safety: Protect eyes and hands
2. Set for 0.002" clearance
3. "Pierce" or "splay" cutting
4. Open throat

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

IX. MATERIALS: STEEL, STEEL STOCK, ALLOYS

A. Properties of Steel

1. Strength ductility, hardness, etc.
2. Corrosion resistance
3. Galvanizing process

B. Description: Use of Alloys

1. Gauges, sizes, weights
2. U. S. Standard gage
3. Trade name, manufacturers
4. Grades, types, paintability
5. Manufacturer's charts, tables, slide charts

C. Steel Stock

1. Cold rolled sheets, black iron
2. Band iron, flat bar
3. Wire, rod
4. Angle iron, etc.

X. MATERIALS

A. Fasteners

1. Sheet metal screws
2. Machine bolts and nuts
3. Rivets

B. Aluminum

1. Properties
2. Processes
3. Uses
4. Determining gage, weight, and thickness

C. Stainless Steel

1. Properties
2. Processes
3. Uses
4. Determining gage, weight and thickness

D. Black Iron

1. Properties
2. Processes
3. Uses
4. Determining gage, weight and thickness

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

E. Galvanized Iron

1. Properties
2. Processes
3 Uses
4. Determining gage, weight and thickness

F. Copper

1. Properties
2. Processes
3. Uses
4. Determining gage, weight and thickness

G. Hasp, Hinges, Catches

1. Type required
2. Inside, outside, piano
3. With or without lock
4. Number needed

XI. BLUEPRINT READING

A. Measurement

1. Inch rule and fractional decimals
2. Use of rules and square
3. Angular measurement

B. Drawing

1. Orthographic projection
2. Precision drawings

C. Symbols

1. Drafting symbols
2. Welding symbols

D. Sheet Metal Shop Procedures

1. Material weight and thickness
2. Estimating methods

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

XII. LAYOUT AND DEVELOPMENT

A. Development Plane Figures

1. Trapezoids
2. Angles
3. Circles

B. Developing Transition Parts

1. Transition joint
2. Transition offset

XIII. RADIAL LINE DEVELOPMENT

A. Principles

1. Determining apex and vertex
2. Slant heights and true lengths
3. Views needed for radial line development

B. Need for Radial Line Development

1. Cones
2. Reducers and increasers
3. Hoppers

C. Methods

1. Step off methods
2. Strap method

D. Conical Shaped Jobs

1. Stretchouts
2. Determining radius
3. Elements of a cone

E. Pyramid Shaped Jobs

1. Order of sides in stretchout
2. Brake lines

F. Pieced Jobs

1. Jobs requiring two or more patterns

G. Taper on a Pitch

1. Miter lines
2. Sweeping a taper

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

XIV. TRIANGULATION

A. Principles of Triangulation

1. Radial line principles
2. Determining the number of true lengths required

B. Triangle Used in Triangulation

1. True length triangles
2. Using the altitude, base, and hypotenuse

C. Views Used in Triangulation

1. Plan
2. Elevation
3. Working views
4. Foreshortened views

D. Patterns

1. Transferring measurement to patterns
2. One, two and four pieced patterns

E. Square to Rounds

1. Centered square to round
2. Square to round on a pitch
3. Square to round off center

F. Oblong Fittings

1. Determining center and flats
2. Center flair
3. Oblong to round
4. Oblong to square

XV. POWER EQUIPMENT

A. Spot Welder

1. Safety

a. Guard
b. Glasses
c. Checking leakage to ground

2. Electrodes

a. Selecting electrodes
b. Cleaning and filing electrodes

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

3. Settings

   a. Timer setting
   b. Setting ampere regulator
   c. Cooling pressure

4. Cycle

   a. Cycle of induction welding
   b. Heat
   c. Time
   d. Pressure

5. Capacities

   a. Materials and gages

6. Welds and penetration

   a. Types of spot welds
   b. Checking penetration

7. Maintenance

B. Drill Press

1. Safety

   a. Glasses
   b. Guards

2. Adjustments and settings

   a. Cutting speeds
   b. Pulley adjustments
   c. Chuck and drill sizes
   d. Stop adjustments

3. Hold down equipment

   a. Vises
   b. Parallel bars

4. Maintenance

   a. Lubrication

C. Grinder

1. Safety

   a. Glasses
   b. Shields

2. Grinding Wheels

   a. Grain
   b. Structure
   c. Silican carbide
   d. Aluminum oxide
   e. Abrasives
   f. Grade and bond

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

3. Mounting the Wheel
    a. Using proper bushing
    b. Balancing
    c. Using correct wheels
    d. Checking for true
4. Wheel dressers
    a. Use types
    b. Maintaining wheel properly

D. Bandsaw
1. Safety
    a. Glasses
    b. Guards
2. Blades
    a. Sizes
    b. Types
    c. Grades
    d. Teeth
3. Adjustments
    a. Speed
    b. Tension
    c. Feed
    d. Blade
4. Blade welder
    a. Fitting and blade ends
    b. Setting blade welder
    c. Welding blade
5. Maintenance
    a. Lubrication

E. Power Hack Saw
1. Safety
    a. Glasses
    b. Guards
2. Adjustments
    a. Blade
    b. Speeds
3. Blades
    a. Types and Sizes
4. Capacities
    a. Stock
5. Maintenance

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

F. Power Press Brake

1. Safety
2. Loosen and tighten set screws
3. Bring ram down manually
4. Bottom dies for accuracy
5. Avoid off center loading
6. Set multi-bend controls
7. Metal thickness
8. Type of material
9. Angle to be bent
10. Radii needed
11. Maintenance

G. Turret Punch Press

1. Safety
2. Engage guide pin
3. Line up punch and die
4. Maintenance

H. Power Squaring Shear

1. Safety
2. Shear operation
3. Set back and front gauge
4. Maintenance

I. Punch Press

1. Safety
2. Check punch and die alignment
3. Maintenance

J. Sheet Metal Fabricator

1. Safety
2. Types and uses of machines
3. Maintenance

K. Duplicator

1. Safety
2. Types and use of machines
3. Maintenance

L. N/C Fabricator

1. Safety
2. Types and use of machine
3. Maintenance

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

XVI. FABRICATION

A. Cones

1. Frustrum of a cone

B. Square to rounds

1. Square to round on center
2. Square to round to one side

C. Rounds to rounds

1. Round equal taper joint
2. Round taper, one side straight

SVII. WELDING OXY-ACETYLENE

A. Oxy-acetylene Equipment

1. Oxygen and acetylene cylinder const.
2. Pressure regulator
3. Welding torch and tips
4. Welding hoses
5. Gloves and glasses

B. Welding Procedures and Descriptions

1. Brazing
2. Resistance welding
3. Induction welding
4. Arc welding
5. Gas welding
6. Mig welding
7. Tig welding

C. Hazards and Safety of Welding

1. Lighting the torch
2. Turning off the torch
3. Adjusting the regulators
4. Back fire
5. Flash back
6. Clothing and glasses
7. Hose contact with flame

D. Types of Welding

1. Without rod
2. With rod
3. Butt weld
4. Fillet weld
5. Fusion welding
6. Lap welds

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

E. Welding Procedures and Variables

1. Preparation
2. Tip size
3. Grip
4. Flame setting
5. Angle and distance of torch
6. Rate of travel and manipulation
7. Rod size

F. Flame

1. Carburizing
2. Neutral
3. Oxidizing

XVIII. ARC WELDING

A. History, Background

1. Early use of the arc
2. Progress after WWI
3. Bare electrodes

B. Equipment

1. Power supplies
2. Clothing, personal equipment
3. Ventilation requirements

C. Safety Practices

1. Eye protection, first aid
2. Lenses, hoods, injurious rays
3. Skin protection, gloves, leggings, shoes
4. Electrical dangers, shock, burns, cables
5. Safety procedures: tankes, drums, etc.
6. Clean-up procedures after welding

D. Selection of Electrodes

1. Terms
2. Classification, AWS, ASTM
3. Markings end, spot, group
4. Coating, sheilded rods
5. Polarity
6. Types of rods; Steel, aluminum, stainless, etc.
7. Reading electrode charts and tables

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

E. Striking an Arc

1. Scratching method
2. Correct arc length
3. Correct amperage
4. Maintaining the arc
5. Rate of travel

F. Welding Operations

1. Fait heads
2. Weaving motion
3. Butt welds
4. Fillet welds

G. Corner and Edge Welds

1. Horizontal
2. Vertical
3. Overhead

H. Identification and Characteristics of Metals

1. Method of identifying metals
   a. Surface appearance
   b. Sound
   c. Spark test
   d. Fracture
2. Melting points for metals and alloys
3. Grain structures
4. Manufacture and characteristics of metal
   a. Iron ore
   b. Gray cast iron
   c. White cast iron
   d. Malleable iron
   e. Wrought iron
   f. Steel

I. Controlling Distortion

1. Expansion and contraction
2. Upsetting
3. Shrinkage forces
4. Intermittent welds
5. Proper welding sequence
6. Clamps jigs
7. Heat

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

J. Symbols

1. American Welding Society
   a. Basic symbols and location significance
   b. Supplementary symbols

X. Test and Inspection

1. Types and tests and purposes
2. Methods of testing
   a. Tension
   b. Bend
   c. Shear
   d. Break
3. Visual inspection
4. Principles defects
5. Gauge testing

XIX. MIG WELDING

A. Safety

1. Eye and face protection
2. Electrical safety precautions
3. Protective clothing

B. Mig Power Supply

1. Set voltage
2. Set slope

C. Wire Feed

1. Types of wire

D. Gas

1. Types needed

XX. TIG WELDING

A. Safety

1. Eye and face protection
2. Electrical safety precautions
3. Protective clothing

B. Machine Operation

1. Gas
2. Water
3. Amperage

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

XXI. METAL FINISHING

A. Degreasing Procedures

1. Types of coating
2. Safety
3. Size of part
4. Procedure for loading and unloading

B. Spray Painting

1. Type of thinner
2. Adjust spray gun and regulator
3. Right stroke to use
4. Disassemble and clean spary gun

XXII. MATERIALS: PLASTICS

A. Terms, Definition, History

B. Types

1. Thermoplastics

a. Polyvinylchloride PVC
b. Polyethlene
c. Acrylic
d. Acroton ABS

2. Thermosetting

a. Polyester
b. Epoxies
c. Phenolic

C. Application

1. Advantages over metal in various industrial uses

D. Welding Plastics

1. Hot gas method
2. Preparation sheets
3. Welding position and procedure
4. Types of welds

E. Fastening Procedures

1. Welding
2. Cementing, adhesives
3. Riveting

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

XXIII. SAFETY

A. Eye

1. Glasses
2. Shields

B. Correct Dress

1. Shoes
2. Hair
3. Clothing

C. Handling Metal

D. Correct Use of Tools

E. Correct Use of Machines and Equipment

F. Electrical Precautions

G. Safety First and Last

XXIV. CUSTOMER RELATIONS AND BUSINESS PRACTICES

A. Dress and Appearance - First Impressions

1. Clothing

a. Neat
b. Clean

2. Personal Appearance

a. Cleanliness
b. Personal hygiene
c. Manners

1. Polite
2. Tactful

B. Courtesy to the Customer

1. Telephone communications

a. Courteous
b. Sincere
c. Listen
d. Never argue but stand on facts
e. Misunderstanding produces ill will

LESSON PLAN NO.	DATE SCHEDULED	DATE PRESENTED	DATE TESTED

2, Association in person

a, Call customer by name
b. Pronounce name correctly
c. Efficient service
d. Brief, thorough
e. Satisfy complaints
f. Enthusiasm about company
g. Enthusiasm about product

C. Customer Psychology

1. Get the customer's story
2. Agreement precedes disagreement
3. Knowledge of product
4. Ignorance kills customer confidence
5. Show initiative

D. Business Practices

1. Maintain good records

a. Customer files
b. Service calls
c. Time spent
d. Parts used
e. Billing
f. Correspondence
g. Inventory
h. Service bulletins
i. Cost (all costs)
j. Taxes (all taxes)
k. Gross income
l. Net profit

E. Ethics

1. Workmanship
2. Parts cost
3. Labor cost
4. Overhead cost
5. Promptness
6. Contractual and implied obligations
7. Customer consideration

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B-2	Flat Butt Welds
C-1	Fillet Welds, Steel
C-2	Vertical Welds, Steel
E-1	Oxy-Acetylene Cutting
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